BIOLOGICAL CONTROL AGENTS UNDER DEVELOPMENT FOR WEED MANAGEMENT IN FLORIDA VEGETABLES

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Weed control in the absence of methyl bromide is a major concern to vegetable producers. Losses in fresh market tomatoes in Florida due to weed pressure, with methyl bromide available, have been estimated at more than US$291 million (Bridges, 1992). In the absence of methyl bromide, these losses are likely to increase. Alternative soil disinfestation methods have been tested in several locations throughout Florida and a few methods have provided adequate control of some weeds. Yellow and purple nutsedge have been the focus of several studies and are the most significant weed problems facing growers immediately after cessation of methyl bromide use. However, a greater diversity of weed problems is expected to develop without the broad-spectrum activity of methyl bromide. Studies were conducted to identify what weed problems arise with the use of alternative soil disinfestation practices in production fields. Nutsedges (*Cyperus* spp.), pigweeds (*Amaranthus* spp.), grass weeds belonging to several genera, and purslane (*Portulaca* spp.) were among the most commonly occurring weeds in plots treated with various alternative fumigants and soil solarization. Fungal biological control agents for these weeds were either already under development or were sought.

A fungus identified as *Dactylaria higginsii* was isolated from diseased purple nutsedge in 1994. The isolate was highly pathogenic to purple (*Cyperus rotundus*) and yellow nutsedge (*C. esculentus*), as well as globe sedge (*C. globulosus*), annual sedge (*C. compressus*), rice flatsedge (*C. iria*), and green kyllinga (*Kyllinga brevifolia*). Application of *D. higginsii* conidial suspensions to purple nutsedge plants resulted in significant reductions in tuber numbers, shoot numbers, shoot dry weight, and tuber dry weight. The fungus was tested against field populations of purple nutsedge. Three post-emergence applications resulted in >90% mortality of purple nutsedge and caused significant reductions in tuber numbers produced. In greenhouse studies, application of a suspension of conidia reduced nutsedge competition so that tomato yields from these treatments were equal to that of the weed-free control (Kadir et al., 2000). Collaborative agreements are in place for the commercialization of this fungus as a mycoherbicide. Laboratory and field trials are underway to determine the compatibility of this fungus with both pre-plant and post-emergent chemicals.

The fungus, *Phomopsis amaranthicola* (Rosskopf et al., 1999), was determined to be an effective pathogen on a variety of *Amaranthus* spp. The host range of the fungus was tested using a centrifugal phylogenetic scheme with *Amaranthus hybridus* as the focal plant. Thirty-three accessions belonging to 22 species of *Amaranthus* and 56 plant species outside of the genus were tested for susceptibility to the fungus. *P.*

amaranthicola was highly virulent on several species within the genus *Amaranthus* and was not pathogenic on any species outside of the genus. Field trials were conducted using *P. amaranthicola* conidial and mycelial suspensions. Species tested in the field included *Amaranthus hybridus*, *A. lividus*, *A. viridus*, *A. spinosus*, and a triazine-resistant accession of *A. hybridus*. Double applications of a high concentration of conidia (6×10^7 conidia/ml) resulted in the most effective control of the weeds (Rosskopf, et al., 2000). The fungus is currently being tested for compatibility with crop protection chemicals and for parameters necessary for large-scale inoculum production.

A species of *Dreschlera* and two species of *Exserohilum* were isolated from large crabgrass, crowfootgrass, and johnsongrass in Florida. These pathogens killed the following eight grasses when tested in greenhouse trials: bermudagrass, large crabgrass, crowfootgrass, guineagrass, johnsongrass, southern sandbur, Texas panicum, and yellow foxtail. All grasses were highly susceptible (disease severity ranging from 82-100%) to the individual pathogens as well as a mixture of all three pathogens. In field trials, the three pathogens individually and in combination were most effective in causing plant mortality of large crabgrass, crowfootgrass, johnsongrass, guineagrass, southern sandbur, Texas panicum, and yellow foxtail when applied with an oil emulsion carrier (Chandramohan, 1999). Current research with pathogen system includes reformulation of the most promising isolates for use in organic vegetable and citrus crops, the effects of the fungi on grass competition with tomato and pepper, and testing of sugarcane varieties for susceptibility to infection by the fungi.

The effects of competition from *Portulaca* in Florida tomato, pepper, and strawberry production are not known. While the weed is found throughout these production areas, its impact on crop development and fruit yields has not been established. These studies are ongoing. Naturally occurring epidemics of a disease caused by *Dichotomophthora portulacae* are common throughout vegetable production areas in Florida (personal observation). Previous attempts to develop this fungus as a biological control agent for *Portulaca* in New York state were discontinued due to inadequate humidity during the production season. In greenhouse studies, the unformulated fungus was able to cause infection under temperatures ranging from 15-33 C, with symptoms developing within 48 hours of inoculation (Klisiewicz, 1985). The current studies with this pathogen system include host-range testing of the locally occurring isolates, optimization of culturing procedures, and field testing of the organism on native *Portulaca oleracea* populations.

<u>References</u>

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